2014 Materials and Manufacturing Summer Teachers' Institute

(1)

Generic Lesson Plan

Unit of Study: Unit Conversion, Cell Structure, Forces, Measurement Skills

Classroom: Middle School / High School

Number of Students:

Grade Level:

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1. **TEACHER'S OBJECTIVE(S) FOR THE CLASS:**

   - **Major Curricular Concept:** Biology Cell Structure Physics/Middle School Science Forces, Properties of Matter
   - **STEM Applications** Chemistry Chemical Properties
   - **Common Core or Standards' Reference (s)** CT Science Standards Inquiry Based Learning RST Standards for Summarizing Key Ideas from Reading Articles on Wood Types & Uses of Wood for Various functions.

What students will know/understand and be able to do as a result of the lesson:

Biology - The structure & function of plant cells & taxonomy of Tree Samples.
Chemistry - How does the chemical composition affect density. Phys. Science - Regular & Irregular Volumes/Strength of Matl

2. **CLASS ACTIVITY:** **(Include planned instructional strategies to facilitate student learning):**

Provide samples of 4 types of wood of various sizes & shapes. Present a problem to investigate & have them design experiments based on their interest. This can be Biology, Chemistry, or Physical Science

3. **MATERIALS:** **(What is required to perform the activity?)**

Masses, Water
Wood Samples, Scale
Rulers (Both Metric & Inches)
Beaker, Microscope, Appropriate Chemicals
(Hand Lenses)

4. **OTHER FACTORS:** **Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.**

This activity lends itself to differentiated instruction. Presentation, collaboration, & math skills are being utilized & observed.

5. **OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:**

6. **OTHER COMMENTS:** **(Regarding Expected Outcome)**

These questions should lead to more questions that students may want to investigate. Ex. What wood do they use to build houses in Northern CT vs Seashore. Why TREX versus wood? What type of wood do they use for boats, etc? How do you extend the life of the wood?

7. **HOW WILL STUDENT SUCCESS BE MEASURED?** (Rubric Based)

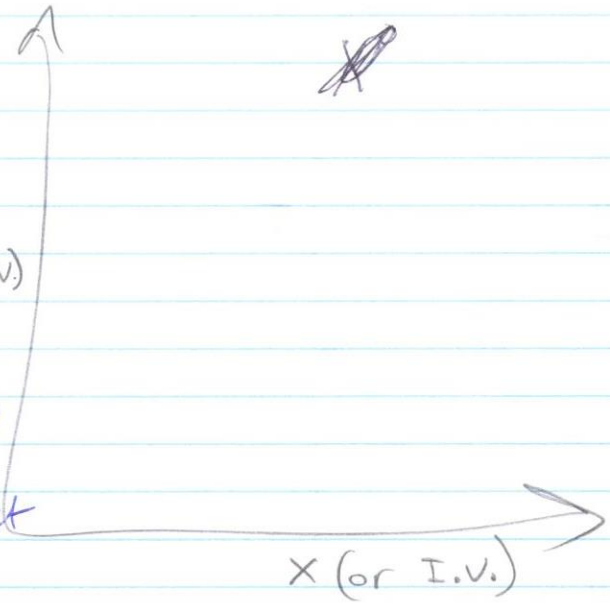
Lab Report given to teacher; Assessment is ongoing because the teacher will be walking around to monitor the progress of each station. The teacher will give help when needed. There also be an Exit Slip to answer Important Concepts Must

Physics

Biology –

Phy. Science

Math → ~~distance~~
x- diameter of circular object
y- circumference of circular object



sentence model

As _____ _____ from _____ to _____
IV (changes, increases, decreases) # #

_____ _____ from _____ to _____.
DV (changes, increases, decreases) # #

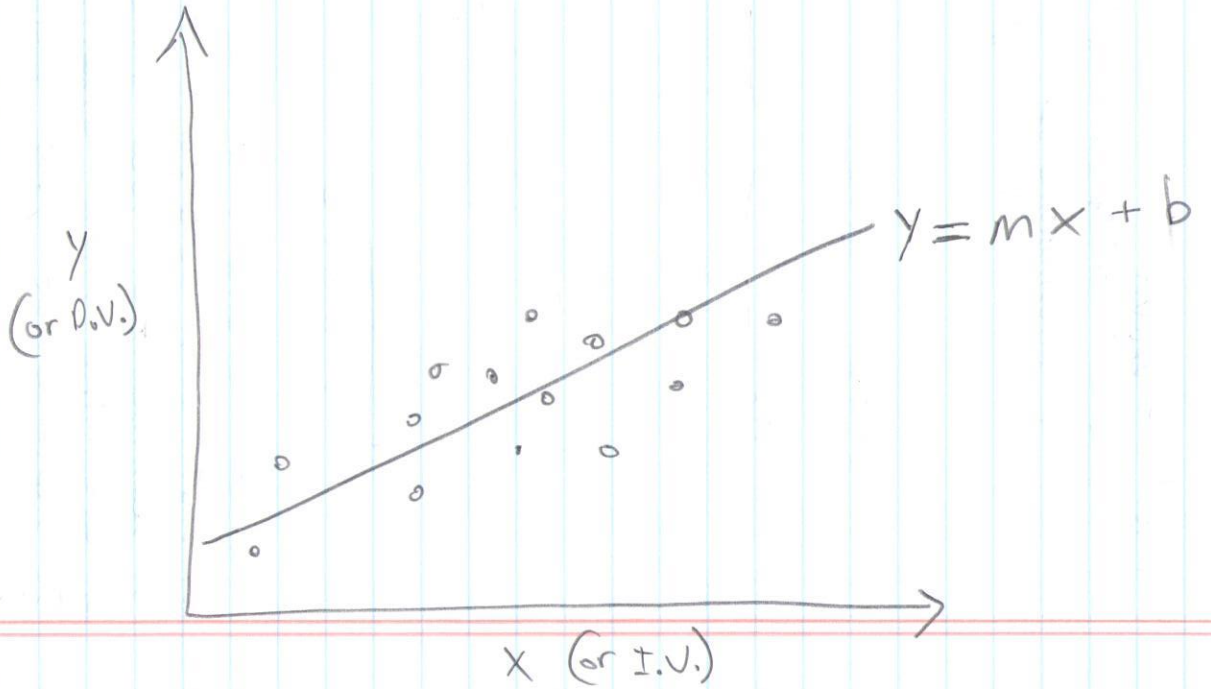
linear equation
$y = mx + b$

1) generate quantitative data
2) plot x-y data points on an x-y scatter plott.
3) summarize your data w/ a sentence
4) use the linear equation to make a prediction.
5) summarize your prediction in a sentence.
6) write a procedure to test your prediction.
7) test your prediction
8) repeat steps #2-3 & draw conclusions

Physical Science – ~~ice~~ water → temp. rises stop before boils
temp (x)
temp (y)

As I.V. (changes, decreases, increases) from # to #

while D.V. (changes, decreases, increases) from # to #.



Generic Lesson Plan

Unit of Study: Physical Science

Classroom:

Number of Students: 25

Grade Level: 9

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1. **TEACHER'S OBJECTIVE(S) FOR THE CLASS:**

- **Major Curricular Concept:** phase changes (in water)

- **STEM Applications** generating quantative data
  interperlation of graphs, drawing conclusions
  changes in temperature and movement of molecules

- **Common Core or Standards' Reference (s)** translation of quantative or ~~Changes in temperature~~ technical information ~~expressed in words~~ evaulate hypothesis
  draw conclusion
  8.SP.1: Construct and interpret scatter plots.

What students will know/understand and be able to do as a result of the lesson:

Students will collect data + graph it, evaluate hypothesis will relate changes in temperature to changes into molecular forces + bonds

2. **CLASS ACTIVITY:** **(Include planned instructional strategies to facilitate student learning):**

1. generate quantative data
2. plot x-y datapoints on an x-y scatter plot
3. summerize your data w/a sentence
4. use liner equation to make a prediction
5. summerize your prediction in a sentence
6. write a procedure to test your prediction
7. test your prediction
8. repeat steps #2-#3-4 to draw conclusions

3. **MATERIALS:** **(What is required to perform the activity?)**

beackers
water
hot plate
Safety glasses
thermometer
graph paper
rulers

students will be learning with water adding heat + ~~thermo~~ measuring temperature + time.

4. OTHER FACTORS: Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

1) expect students will predict ~~~~ time & temperature will always increase

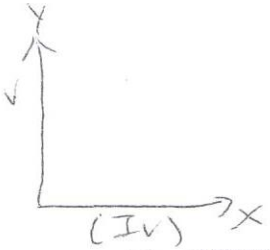
2) Through experimentation student will discover that temperature will not ~~~~ increase ~~can~~ pass 100°C

5. OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:

sentence model:

As _____ (IV) _____ (changes, increases/ decreases) from _____ (#) to _____ (#)

_____ (DV) _____ (changes, increases/ decreases) from _____ (#) to _____ (#).



linear equation: $y = mx + b$

6. OTHER COMMENTS: (Regarding Expected Outcome)

This lesson can be modified to include other subjects. For example in math class students can collect data through measurment (diameter of can, circumference of circle).

7. HOW WILL STUDENT SUCCESS BE MEASURED?

Students will perform experiment recording data.
Students will plot the graph.

2014 Materials and Manufacturing Summer Teachers' Institute

Generic Lesson Plan

Unit of Study: Human Body + Organ Systems

Classroom: Middle School (Chem. physics. Biology)

Number of Students: 24 (ideally)

Grade Level: 6-12 (modifiable)

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1. **TEACHER'S OBJECTIVE(S) FOR THE CLASS:**

   - **Major Curricular Concept:** properties of materials

   - **STEM Applications**

     to replace anatomical structures with an artificial structure.

   - **Common Core or Standards' Reference (s)**

     PS1. A : Structure + Properties of Matter

What students will know/understand and be able to do as a result of the lesson:

- analyse + determine the best material for limb-replacement (specifically a long-bone: femur)

2. **CLASS ACTIVITY:** **(Include planned instructional strategies to facilitate student learning):**

   Students will test a variety of materials (metals) in solutions of different pH's.

   Students will conduct research to assist in making their determination.

3. **MATERIALS:** **(What is required to perform the activity?)**

   - metal samples
   - test tubes
   - copper sulfate solution
   - water
   - test tube holder
   - computer cart
   - periodic table

4. **OTHER FACTORS:** Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

4/2 students will have prior exposure to and comprehension of ph and concentration of acid(s). Students will have prior exposure + comprehension of the periodic table.

5. **OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:**

SWBAT determine the best material to artificially replace a long bone (femur) in the human body.

SWBAT defend their answer using information determined by experimentation + research.

6. **OTHER COMMENTS:** (Regarding Expected Outcome)

extension → students could rate their choices using different materials and use their research/data to defend their answers.

7. **HOW WILL STUDENT SUCCESS BE MEASURED?**

- Students will create a poster/power point etc. and present their findings to their peers. (with a rubric)
- a self-reflection piece "What ~~bt~~ would they use and why?!

2 biologists, chemistry, aerospace GROUP 4

2014 Materials and Manufacturing Summer Teachers' Institute

Generic Lesson Plan

Unit of Study: It's a Slippery Sloop: Can we make an environmentally-friendly boat hull paint?

Classroom: Science

Number of Students:

Grade Level: 6 - 12

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1. **TEACHER'S OBJECTIVE(S) FOR THE CLASS:**

Key Question: Ships must prevent the attachment of barnacles; however, the paints currently used harm the ocean ecosystem. Can a safe paint be developed?

- **Major Curricular Concept:**

- **STEM Applications**

Core Idea PS 1: Matter and Its Interactions
PS1:B: Chemical Reactions

- **Common Core or Standards' Reference (s)**

Reading Standards for Literacy in Science and Technical Subjects 6-12

6-8 #1. Cite specific textual evidence to support analysis of science and technical texts.

9-10 #3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

11-12 #9. Synthesize information from a range of sources... into a coherent understanding...

What students will know/understand and be able to do as a result of the lesson:

* Anti-fouling of boat hulls is a goal to preserve the boat from barnacle growth.
* The elements to create paint that have an anti-fouling effect can have negative environmental impact (copper)

2. **CLASS ACTIVITY: (Include planned instructional strategies to facilitate student learning):**

* Experiment with copper to see bacteria growth on surface.

3. **MATERIALS: (What is required to perform the activity?)**

☐ Copper Association reference materials — bacterial growth on metal surfaces
Development (copper alloy pens being given to doctors)

4. OTHER FACTORS: Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

Students will be asked to understand the concept of "anti fouling" paint for ship hulls to prevent "accidental tourists"/barnacle growth.
- What happens to oyster beds when boats pass over them?
- What are the caustic elements in paint?
- What are the components in marine paint? In what proportion?
- What are the pros/cons of current paint compositions?
- How long does the paint last (effectively protect hull)?
- How does water salinity react with paint?
- What is hydrospace engineering?
- The elements that comprise paint – pick one + trace where that element exists in your everyday life?

5. OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:

This unit will be differentiated by
1) Offering a pre-test to determine prior student knowledge of elements / paint / marine ecology + technology interaction
2) Student who show advanced knowledge or ability will have an enrichment option to go in-depth in their choice of aspect of this unit
3) Struggling students will receive reading materials at their level / simpler version of hands-on experiments.

6. OTHER COMMENTS: (Regarding Expected Outcome)

7. HOW WILL STUDENT SUCCESS BE MEASURED?

* Students will present on the pros/cons of current hull paints
* Students will present on the elements that compose paint
* Students will make a product that selects one element from paint and shows the role of that element in their everyday life
* Student will research alternative recipe ideas for hull-protecting paint

2014 Materials and Manufacturing Summer Teachers' Institute

Generic Lesson Plan

Unit of Study:

Classroom:

Number of Students:

Grade Level: 7-12

1. **TEACHER'S OBJECTIVE(S) FOR THE CLASS:** how can we get the biggest % rise?

- **Major Curricular Concept:** Gas production by microorganism
- **STEM Applications** - Chabaso Bread Co (video) manufacturing
  - problem solving in manufacturing
- Common Core or Standards' Reference (s)

What students will know/understand and be able to do as a result of the lesson:

how to make bread to ~~make~~ meet certain specifications.

2. **CLASS ACTIVITY:** (Include planned instructional strategies to facilitate student learning):
   (1) Build background knowledge on bread making and yeast fermentation process.
   (2) Research best bread making ratios.
   (3) Day 1 Trials - figure ratios process overnight
   (4) Share best % ↑ Day 2 - use information to decide Day 2 Trial ratios w/ 3 trials
3. **MATERIALS:** (What is required to perform the activity?)

flour
yeast
water
thermometer
straw created box to dimensions (4) conclusion ex. 2x3x2cm
200 mL beakers (or) other tubes

4. OTHER FACTORS: Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

5. OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:

6. OTHER COMMENTS: (Regarding Expected Outcome)

7. HOW WILL STUDENT SUCCESS BE MEASURED?

Did control all variables?
exper. validity
conclusion & reasonable recommendation to Chabaso Bread Co using exp. data.

Osmosis Lesson Plan

Lesson Plan Questions to Consider

1) Which experience in this institute interested you the most?
materials - how to make them stronger
2) Which experience provided information/insight/ knowledge that intrigued you the most? drilling metals - blue hot - how to do it right
breaking drill
3) Which experience supplied you with new and novel information?
visiting the sites
4) Which experience do you think would impress your students the most?
hands on learning
5) Which experience best portrayed what STEM involves?
employers talking about math skills and creative problem solvers
6) Which experience(s) do you wish to bring back to your classroom?
applied science
7) Why? it gives a purpose to learning science
8) How would you structure an effective lesson around this experience? → give an objective to students with materials to discover the solution. Maybe them small [illegible]
relating what their learning has to do with the real world
9) What would the objective of this lesson be? inviting people from manufacturing to speak and relate whenever possible.
learn about osmosis / what is moving in and out
10) Would this be an experiential learning activity?
yes
11) How will you use all of the elements of STEM in this lesson?
students will measure, weigh - look up molecule size, pore size of
12) Which elements would you stress? membranes -
You learned this by yourself
13) Will this be a singular lesson or be delivered over a number of days?
perhaps a few days of thought
14) What result(s) would you be seeking?
Students realize that what solution you put an egg in will influence the size of the egg.
15) How will you ensure that all of your students are participating?
talk to them, ~~[illegible]~~
16) How would you measure the result(s) and/or the effectiveness of the lesson? students would keep data -
give an ~~explanation~~ explanation for your observations

a slippery soup -